Structural Setting, Mineralogical Characteristics and Geochemical Footprints of Banded-Iron-Formation-Hosted Gold Mineralisation in the Geraldton Area, Ontario

Z. Tóth[1], B. Lafrance[1], B. Dubé[2], P. Mercier-Langevin[2], V.J. McNicoll[3]
[1]Mineral Exploration Research Centre, Department of Earth Sciences, Goodman School of Mines, Laurentian University, Sudbury, ON,Canada; [2]Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada, Québec City, QC, Canada; [3]Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada, Ottawa, ON, Canada

Abstract

The Beardmore-Geraldton Greenstone Belt (BGB) is located along the boundary between the Wabigoon and Quetico Subprovinces of the Archean Superior Province. Over the past century, it produced more than 4.1 million ounces of gold from quartz-carbonate veins hosted within altered mudstone, sandstone, banded iron formation and 2694±1 Ma quartz-feldspar porphyry. Several gold deposits in the Geraldton area occur along the Tombill-Bankfield Deformation Zone. The latter is a zone of intense deformation characterised by a strong S_2 foliation axial planar to F_2 folds. S_2 and F_2 are overprinted by a younger S_3 foliation axial planar to Z-shaped F_3 folds, dextral shear bands, and other dextral shear indicators such as asymmetrical strain shadows around clasts. A folded S_1 foliation is locally present in the hinge of F_2 folds. Two stages of iron-carbonate alteration are documented: an early stage forming massive Fe-carbonate veins whereas quartz-carbonate veins and associated ankerite replacement characterised the second stage. In sandstone and mudstone, gold is associated with pyrite and arsenopyrite in sericite-carbonate and sericite ± chlorite alteration halo around the veins. In banded iron formation, gold is associated with trace to semi-massive sulphide (pyrite ± arsenopyrite ± pyrrhotite) replacement of the host iron formation next to the veins. In pervasively altered quartz-feldspar porphyry, lower but more uniform gold concentrations are associated with veins surrounded by iron carbonate-sericite-sulphide ± chlorite alteration halo. The quartz-carbonate veins were boudinaged prior to F_2 folding, suggesting that they were emplaced either pre- or early-D_2. This differs from previous interpretations which relate the emplacement of gold mineralisation to D_3 dextral shearing along the Tombill-Bankfield Deformation Zone. Preliminary geochemistry of altered rocks suggests that gold grades increase with higher total sulphur-content. The altered rocks underwent relative silica leaching during sulphidation and carbonatisation. The breakdown of feldspar during sericitisation resulted in relative enrichment in K_2O and depletion in Na_2O. Altered rocks with high Au values generally have high As and Te values.